CLAIMS

WE CLAIM:

1. A variable inlet guide vane actuation system, comprising:

a control circuit adapted to receive one or more guide vane position command signals and operable, in response thereto, to supply guide vane actuation control signals;

a primary electric motor coupled to receive the guide vane actuation command signals and operable, in response thereto, to supply a drive force;

a plurality of drive mechanisms each coupled to receive the drive force; and

a plurality of actuator assemblies, each actuator assembly coupled to at least one of the drive mechanisms and configured, upon receipt of the drive force, to selectively move between a closed position and an open position.

2. The system of Claim 1, further comprising:

a secondary electric motor coupled to receive the guide vane actuation control signals and operable, in response thereto, to supply a drive force.

3. The system of Claim 2, wherein the control circuit includes at least a primary channel and a secondary channel, each control circuit channel adapted to receive the guide vane position control signals and operable, in response thereto, to supply guide vane actuation control signals.

4. The system of Claim 3, wherein:

the primary electric motor is coupled to the control circuit primary channel; and

the secondary electric motor is coupled to the control circuit secondary channel.

5. The system of Claim 3, wherein the primary and secondary motors are each coupled to both the control circuit primary and secondary channels.

6. The system of Claim 3, wherein the control circuit is configured such that when the primary channel is active the secondary channel is inactive, and vice-versa.

7. The system of Claim 2, further comprising:

a differential gear assembly coupled between the primary and secondary electric motors.

8. The system of Claim 1, wherein the drive mechanisms each comprise a flexible shaft.

9. The system of Claim 1, wherein each actuator is adapted to couple to a gas turbine engine unison ring.

10. The system of Claim 1, further comprising:

a plurality of actuator position sensors, each actuator position sensor coupled to an actuator assembly and configured to supply position signals representative of actuator assembly position.

11. The system of Claim 1, further comprising:

a brake coupled to the primary electric motor and configured to selectively (i) engage the primary electric motor, whereby the primary electric motor is prevented from supplying the drive force and (ii) disengage the primary electric motor, whereby the primary electric motor is allowed to supply the drive force.

12. The system of Claim 11, wherein:

the brake is adapted to receive brake control signals and is operable, in response thereto, to selectively engage and disengage the primary electric motor.

13. The system of Claim 11, wherein the brake is configured to engage the primary electric motor at least when the brake assembly is de-energized.

14. The system of Claim 1, further comprising:

a rotational position sensor coupled to the primary electric motor and configured to supply one or more signals representative of a rotational position of the primary electric motor.

15. The system of Claim 14, wherein the control circuit is (i) coupled to receive the rotational position signals from the rotational position sensor and (ii) configured to supply the guide vane actuation control signals based at least in part on the rotational position signals.

16. The system of Claim 1, wherein the primary electric motor is a brushless DC motor.

17. The system of Claim 1, wherein the primary electric motor is an AC induction motor.

18. A variable inlet guide vane actuation system, comprising:

a control circuit including a primary channel and a secondary channel, each channel adapted to receive one or more guide vane position control signals and operable, in response thereto, to selectively supply guide vane actuation control signals;

a primary electric motor coupled to receive the guide vane actuation control signals from the primary channel and operable, in response thereto, to supply a drive force;

a secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel and operable, in response thereto, to supply a drive force; and

an actuator assembly coupled to the primary and secondary electric motors and configured, upon receipt of the drive force therefrom, to selectively move between a closed position and an open position.

19. The system of Claim 1, wherein the control circuit is configured such that when the primary channel is active the secondary channel is inactive, and vice-versa.

20. The system of Claim 2, the actuator assembly comprises:

a differential gear assembly coupled between the primary and secondary electric motors.

21. The system of Claim 1, wherein each actuator is adapted to couple to a gas turbine engine unison ring.

22. The system of Claim 1, further comprising:

an actuator position sensor coupled to the actuator assembly and configured to supply position signals representative of actuator assembly position.

23. The system of Claim 1, further comprising:

a primary brake assembly coupled to the primary electric motor and configured to selectively (i) engage the primary electric motor, whereby the primary electric motor is prevented from supplying the drive force and (ii) disengage the primary electric motor, whereby the primary electric motor is allowed to supply the drive force; and

a secondary brake assembly coupled to the secondary electric motor and configured to selectively (i) engage the secondary electric motor, whereby the secondary electric motor is prevented from supplying the drive force and (ii) disengage the secondary electric motor, whereby the secondary electric motor is allowed to supply the drive force.

24. The system of Claim 10, wherein:

the primary and secondary channels are further operable, in response to the guide vane position control signals, to selectively supply primary and secondary brake control signals, respectively; and

the primary and secondary brake assemblies are coupled to receive the primary and secondary brake control signals, respectively, and are respectively operable, in response thereto, to selectively engage and disengage, respectively, the primary and secondary electric motors.

25. The system of Claim 11, wherein the primary and secondary brake assemblies are configured to engage the primary and secondary electric motor, respectively, at least when the brake assembly is de-energized.

26. The system of Claim 1, further comprising:

a primary rotational position sensor coupled to the primary electric motor and configured to supply one or more signals representative of a rotational position of the primary electric motor; and

a secondary rotational position sensor coupled to the secondary electric motor and configured to supply one or more signals representative of a rotational position of the secondary electric motor.

27. The system of Claim 13, wherein:

the primary channel (i) is coupled to receive the primary motor rotational position signals from the primary rotational position sensor and (ii) is configured to supply the guide vane actuation control signals based at least in part on the primary motor rotational position signals; and

the secondary channel (i) is coupled to receive the secondary motor rotational position signals from the secondary rotational position sensor and (ii) is configured to supply the guide vane actuation control signals based at least in part on the secondary motor rotational position signals

28. The system of Claim 1, wherein the primary and secondary electric motors are each brushless DC motors.

29. The system of Claim 1, wherein the primary and secondary electric motors are each AC induction motors.

30. A variable inlet guide vane actuation system, comprising:

a control circuit including a primary channel and a secondary channel, each channel including a first motor controller and a second motor controller, each motor controller in each channel adapted to receive one or more guide vane position control signals and operable, in response thereto, to supply guide vane actuation control signals;

a first primary electric motor coupled to receive the guide vane actuation control signals from the primary channel first motor controller and operable, in response thereto, to supply a drive force;

a second primary electric motor coupled to receive the guide vane actuation control signals from the primary channel second motor controller and operable, in response thereto, to supply a drive force;

a first secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel first motor controller and operable, in response thereto, to supply a drive force;

a second secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel second motor controller and operable, in response thereto, to supply a drive force;

a first actuator assembly coupled to the first primary and first secondary electric motors and configured, upon receipt of the drive force therefrom, to selectively moe between a closed position and an open position; and

a second actuator assembly coupled to the second primary and second secondary electric motors and configured, upon receipt of the drive force therefrom, to selectively move between a closed position and an open position,

wherein the control circuit is configured such that when the primary channel is active the secondary channel is inactive, and vice-versa.

31. The system of Claim 1, wherein the control circuit is configured such that when the primary channel is active the secondary channel is inactive, and vice-versa.

32. The system of Claim 2, the actuator assembly comprises:

a differential gear assembly coupled between the primary and secondary electric motors.

33. The system of Claim 1, wherein each actuator is adapted to couple to a gas turbine engine unison ring.

34. The system of Claim 1, further comprising:

an actuator position sensor coupled to the actuator assembly and configured to supply position signals representative of actuator assembly position.

35. The system of Claim 1, further comprising:

a primary brake assembly coupled to the primary electric motor and configured to selectively (i) engage the primary electric motor, whereby the primary electric motor is prevented from supplying the drive force and (ii) disengage the primary electric motor, whereby the primary electric motor is allowed to supply the drive force; and

a secondary brake assembly coupled to the secondary electric motor and configured to selectively (i) engage the secondary electric motor, whereby the secondary electric motor is prevented from supplying the drive force and (ii) disengage the secondary electric motor, whereby the secondary electric motor is allowed to supply the drive force.

36. The system of Claim 10, wherein:

the primary and secondary channels are further operable, in response to the guide vane position control signals, to selectively supply primary and secondary brake control signals, respectively; and

the primary and secondary brake assemblies are coupled to receive the primary and secondary brake control signals, respectively, and are respectively

operable, in response thereto, to selectively engage and disengage, respectively, the primary and secondary electric motors.

37. The system of Claim 11, wherein the primary and secondary brake assemblies are configured to engage the primary and secondary electric motor, respectively, at least when the brake assembly is de-energized.

38. The system of Claim 1, further comprising:

a primary rotational position sensor coupled to the primary electric motor and configured to supply one or more signals representative of a rotational position of the primary electric motor; and

a secondary rotational position sensor coupled to the secondary electric motor and configured to supply one or more signals representative of a rotational position of the secondary electric motor.

39. The system of Claim 13, wherein:

the primary channel (i) is coupled to receive the primary motor rotational position signals from the primary rotational position sensor and (ii) is configured to supply the guide vane actuation control signals based at least in part on the primary motor rotational position signals; and

the secondary channel (i) is coupled to receive the secondary motor rotational position signals from the secondary rotational position sensor and (ii) is configured to supply the guide vane actuation control signals based at least in part on the secondary motor rotational position signals

40. The system of Claim 1, wherein the primary and secondary electric motors are each brushless DC motors.

41. The system of Claim 1, wherein the primary and secondary electric motors are each AC induction motors.

42. A gas turbine engine system, comprising:

an engine case;

a turbine mounted at least partially within the engine case and having a plurality of moveable inlet guide vanes;

a unison ring rotationally coupled between the engine case and each of the inlet guide vanes; and

a guide vane actuation control system, including:

a control circuit adapted to receive one or more guide vane position control signals and operable, in response thereto, to supply guide vane actuation control signals,

a primary electric motor coupled to receive the guide vane actuation control signals and operable, in response thereto, to supply a drive force;

a plurality of drive mechanisms each coupled to receive the drive force; and

a plurality of actuator assemblies, each actuator assembly coupled between at least one of the drive mechanisms and the unison ring and configured, upon receipt of the drive force therefrom, to selectively rotate the unison ring in either a first or a second direction, to thereby selectively move the inlet guide vanes between a closed position and an open position, respectively.

43. A gas turbine engine system, comprising:

an engine case;

a turbine mounted at least partially within the engine case and having a plurality of moveable inlet guide vanes;

a hardened unison ring rotationally coupled between the engine case and each of the inlet guide vanes; and

a guide vane actuation control system including:

a control circuit including a primary channel and a secondary channel, each channel adapted to receive one or more guide vane position control signals and operable, in response thereto, to supply guide vane actuation control signals,

a primary electric motor coupled to receive the guide vane actuation control signals from the primary channel and operable, in response thereto, to supply a drive force,

a secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel and operable, in response thereto, to supply a drive force, and

an actuator assembly coupled between the primary and secondary electric motors and the unison ring, the actuator assembly configured, upon receipt of the drive force therefrom, to selectively rotate the unison ring in either a first or a second direction, to thereby selectively move the inlet guide vanes between a closed position and an open position, respectively.

44. A gas turbine engine system, comprising:

an engine case;

a turbine mounted at least partially within the engine case and having a plurality of moveable inlet guide vanes;

a unison ring rotationally coupled between the engine case and each of the inlet guide vanes; and

a guide vane actuation control system, including:

a control circuit including a primary channel and a secondary channel, each channel including a first motor controller and a second motor controller, each motor controller in each channel adapted to receive one or more guide vane position control signals and operable, in response thereto, to supply guide vane actuation control signals;

a first primary electric motor coupled to receive the guide vane actuation control signals from the primary channel first motor controller and operable, in response thereto, to supply a drive force;

a second primary electric motor coupled to receive the guide vane actuation control signals from the primary channel second motor controller and operable, in response thereto, to supply a drive force;

a first secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel first motor controller and operable, in response thereto, to supply a drive force;

a second secondary electric motor coupled to receive the guide vane actuation control signals from the secondary channel second motor controller and operable, in response thereto, to supply a drive force;

a first actuator assembly coupled to the first primary and first secondary electric motors and configured, upon receipt of the drive force therefrom, to selectively moe between a closed position and an open position; and

a second actuator assembly coupled to the second primary and second secondary electric motors and configured, upon receipt of the drive

force therefrom, to selectively move between a closed position and an open position,

wherein the control circuit is configured such that when the primary channel is active the secondary channel is inactive, and vice-versa.

45. An engine controller, comprising:

an error circuit adapted to receive at least a signal representative of a commanded inlet guide vane position and a signal representative of actual inlet guide vane position and operable, in response thereto, to supply an error signal representative of an error between the commanded inlet guide vane position and the actual inlet guide vane position; and

a fuel flow control circuit adapted to receive at least a thrust request signal and the error signal and operable, in response thereto, to supply a fuel flow control signal.